

**WHAT IS CLAIMED IS:**

1        1. A method for communicating in a wireless multi-hop system having at  
2 least one base station, at least one relay station, and user equipment, the method  
3 comprising:

4                communicating between a relay station and a base station using a first  
5 radio interface;

6                communicating between user equipment and the relay station using a  
7 second radio interface; and

8                processing the communication between the relay station and the base  
9 station with the first radio interface separately from the communication between  
10 user equipment and the relay station.

1        2. The method claim 1, further comprising multiplexing communication  
2 between the relay station and the base station and between the relay station and  
3 at least one other relay station to create multiple simultaneous data streams.

1        3. The method of claim 2, wherein the relay station is not directly  
2 connected to the base station but is connected to the base station through at least  
3 two different relay stations.

1        4. The method of claim 2, further comprising communicating between  
2 the relay station and multiple base stations.

1        5. The method of claim 4, further comprising dynamically reusing  
2 communication resources between the user equipment the multiple relay stations.

1        6. The method of claim 1, wherein communicating between user  
2 equipment and the relay station comprises communicating a relay station specific  
3 pilot signal.

1        7.    The method of claim 1, wherein the second radio interface comprises  
2    multiple input multiple output transmissions.

1        8.    The method of claim 1, wherein the first radio interface and the  
2    second radio interface operate using a common frequency bandwidth.

1        9.    The method of claim 1, wherein the first radio interface comprise a  
2    macroscopic multiplexing where the relay station is connected to the base station  
3    directly and also via at least one other relay station.

1        10.   The method of claim 1, further comprising sharing resources between  
2    communication using the first radio interface and communication using the second  
3    radio interface, wherein the first radio interface and the second radio interface  
4    operate using different categories of communication links.

1        11.   The method of claim 10, wherein the different categories of  
2    communication links comprises multi-carrier modulation, spread-spectrum  
3    transmission, frequency division duplexing, and time division duplexing.

1        12.   A wireless communication system having a base station and a relay  
2    station that communicate with user equipment, the system comprising:

3                a base station having a first radio transceiver and being connected to a  
4    core network;

5                a relay station having a second radio transceiver and being configured  
6    to communicate with the base station using a first radio interface; and

7                user equipment having a third radio transceiver and being configured  
8    to communicate with the relay station using a second radio interface, wherein the  
9    operation of the first radio interface and the second radio interface are separate  
10   from each other.

1       13. The system of claim 12, wherein the operation of the first radio  
2 interface and the second radio interface includes, at least in part, using the same  
3 frequency bandwidth.

1       14. The system of claim 12, further comprising at least one other relay  
2 station being configured to communicate with the relay station and the base  
3 station.

1       15. The system of claim 14, wherein the relay station communicates with  
2 the base station directly and simultaneously via the at least one other relay station.

1       16. The system of claim 15, wherein the relay station is not directly  
2 connected to the base station but is connected to the base station through at least  
3 one different relay station.

1       17. A device configured for operation in a wireless multi-hop  
2 communication environment, the device comprising:

3               a radio interface that communicates with relay stations in a multi-hop  
4 communication environment; and

5               a processor coupled to the radio interface, the processor providing  
6 commands for multiple input, multiple output communication via the radio interface  
7 when high data rates are needed.

1       18. The device of claim 17, wherein the radio interface comprises multiple  
2 antennas.

1       19. The device of claim 17, wherein the radio interface communicates a  
2 relay station specific pilot signal.

1       20. The device of claim 17, further comprising a memory apparatus  
2 containing identification information.

1        21. The device of claim 17, wherein the radio interface communicates  
2 using time division multiple access.

1        22. A device configured for operation in a wireless multi-hop  
2 communication network, the device comprising:

3                a radio interface that communicates with user equipment and other  
4 network devices in a multi-hop communication network; and

5                a processor coupled to the radio interface, the processor providing  
6 commands for multiple input, multiple output communication via the radio interface  
7 when high data rates are needed.

1        23. The device of claim 22, wherein the radio interface comprises multiple  
2 antennas.

24. The device of claim 22, wherein the radio interface receives a  
relay station specific pilot signal and compares the relay station specific pilot  
signal with an identification signal.